NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Energy Systems Integration Facility Workshop

Bulk Power Systems Integration

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ESIF Purpose

Workshop Breakouts

- Electricity Systems
- Bulk Power Systems
- Thermal Systems and Buildings
- Hydrogen and Fuel Cells systems

Agenda

- **Participant Introductions**
- **Laboratory Presentations**
  - Smart Power Laboratory — Jason Bank
  - Energy Storage Laboratory — Greg Martin
  - Energy Visualization — Josh Hambrick
  - NWTC Grid Testing — Vahan Gevorgian
- **Open Discussions**
  - RE and EE organizational drivers and goals
  - Bulk Power integration challenges
  - Potential ESIF synergies and implementation
  - Capabilities to consider adding to ESIF

General Discussion Points

- Visualization and Computing capability allows real time and historic analysis with many possibilities for linking with other locations
- NWTC, SNL, BNL, WAPA simulator, SolarTAC, Field Tests (Xcel MN battery), BuRec pumped hydro data, tie to Tendril data experience
- Drive ESIF and NWTC grid simulators with test results
- WAPA simulator/training facility: complementarity, good dissemination to grid operators, evolving grid implies more VER incorporation needed, go beyond PI/control room to condition monitoring with syncrophasor data
- "You guys have the computational power to do it in real time, that's what I love about it." - Steve, WAPA
- Visualization is a big deal, human interface and assimilating increasing amounts of critical information in grid operations control rooms (Xcel use of forecasting example)
- Capture, test multi-faceted benefits of storage: arbitrage, ancillary services, grid stability
- Fully test and demonstrate Smart Grid benefits to Bulk/Transmission system
- Many similar capabilities out there: Clemson, Florida, EPRI but plenty of market share to stay busy

How do you anticipate using the ESIF?

- Pasrich, CU: "I think we could use this as a way to develop analytical models at the university."
- Have student interns work at NREL, staff exchange
- Help to actually drive standards in the marketplace …
- Drawing on utility experience, sharing faculty, student interns, etc.
- Interested in using gas turbines for grid support to allow greater penetration of renewables.
- Looking at ramping capabilities of coal and natural gas for load following.
- Learn from us for better training of grid operators.
- Use it to test new technologies that we are considering for deploying.

What type of capabilities are missing from the ESIF ?

- EISF should subscribe to same model interface standards as EPRI uses for SCADA systems. Consider using industry SCADA in Visualization/training
- Where's the EMI chamber?
- Model perturbations to the system? Outages, etc.
- Use of PI platform for data exchange
- Establish high-speed data link between NWTC and ESIF for real-time testing
- Pinpoint location of an outage? (Smart grid capability.) Plus component failure prediction/detection.
- Failure prediction and monitoring, a failure prediction model could change how you operate the grid (trying not to stress a particular transformer?)
- Partnering? Cyberanalysis of an integrated system?
- Risk analysis, effect of dropping a 1-GW load
- Smart Grid analysis, looking at potential common failure elements that could cause major problems.